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ACCESS TO POSTSECONDARY EDUCATION: WHAT IS THE ROLE OF TECHNOLOGY?

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A memorial change must be made in the system of education and knowledge must become so general as to raise the lower ranks of society nearer to the higher. The education of a nation instead of being confined to a few schools and universities for the instruction of the few, must become the national care and expense for the formation of the many.

John Adams, circa 1786

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Executive Summary

Knowledge-based economies, like the United States, require increasing levels of education and training, augmenting access to postsecondary education is an issue of significant importance to the nation. In the U.S., estimates of the proportion of future jobs requiring postsecondary education range from 70 to 90 percent. Even though U.S. higher education enrollments in postsecondary education are at record levels, virtually every state recognizes the need to expand access and increase enrollment in education and training programs after high school.

Compounding the issue of access is the role of technology. Because of technology, and particularly the Internet, opportunities for students to participate in postsecondary education have increased considerably. Thousands of online courses are now available and more and more on-campus courses possess a technology component. Many colleges and universities are finding the Internet to be an effective tool for use with their admissions programs. In addition, education and training through the Internet is becoming big business worldwide.

These developments raise an important policy question. Does technology expand or serve as a barrier to access to postsecondary education, particularly to underrepresented groups? Put another way, has the advent of technology in our colleges and universities and other emerging postsecondary education providers helped or hindered the ability of certain classes of people—such as racial/ethnic and low income groups—from enjoying the benefits of education beyond high school? This public policy issue engenders other corollary questions. To what extent do higher education students have access to technology-based learning, including access to faculty, information, and other learning experiences? Does availability of computing resources or technology in secondary school affect access to postsecondary education? Indeed, how effective is technology in the learning process?

These questions are becoming increasingly important—which prompted the National Postsecondary Education Cooperative (NPEC) to attempt to answer them. Thus, NPEC identified the relationship of access to postsecondary education and the role of technology as an important strategic area for study. This report attempts to address this relationship by identifying four basic themes to help frame the topic. They are: (1) access to postsecondary education—using technology; (2) access to technology-based learning; (3) preparation for using technology, and (4) effectiveness of technology in the teaching/learning process.

Theme I: Access to Postsecondary Education—Using Technology

This theme addresses the degree to which technology has facilitated the opportunity for students to enroll in postsecondary education. It is increasingly clear that technology has expanded the ability of students to participate in postsecondary education. According to the latest available data, it is estimated that almost 55,000 distance education courses were offered in 1997-98 and there were about 1.6 million enrollments in distance education. Also in 1997-98, about one-third of all postsecondary education institutions offered distance education, and another 20 percent planned to offer distance education in the next three years. As the year 2002 begins, close to 3,600 academic programs are offered through distance education.

In addition to the rapid proliferation of new courses and programs, colleges and universities are taking advantage of the Internet to enhance the admissions process and giving potential students the opportunity to apply online. There is also evidence that technology is allowing students to participate in postsecondary education either in their home or workplace, a portion of which would not otherwise enroll in higher education. It appears that technology is opening up new markets of potential students without significantly diminishing the number of students who would enroll in traditional colleges and universities.

Distance education advocates and others state that a major barrier to the ability of technology to enhance access to postsecondary education, however, is the student

financial aid system, particularly Title IV of the Higher Education Act. In October 2001 the U.S. House of Representatives passed a bill, H.R. 1992, to curtail regulations that inhibit students from participating in distance education. If the bill were to pass the Senate and be signed by President Bush, any institution that is currently providing federal financial aid could ignore certain regulations, provided that its loan default rate has been below 10 percent during the previous three years. While many distance education administrators praise the bill, some faculty groups have criticized the measure, saying that the regulations ensure quality in education and that if the rules are rescinded, students could be defrauded by illegitimate operations. As of the date of this report, the bill has not been debated by the Senate.

Theme II: Access to Technology-Based Learning

This theme addresses the extent to which postsecondary education students have access to technology-based learning. The term "digital divide" is a useful framework for this discussion. Digital divide refers to the perceived gap between those who have access to the latest technologies and those who do not.

The evidence regarding whether or not there is a digital divide for households and individuals is somewhat mixed. On one hand, recent data suggest that the overall level of a digital divide in the United States is rapidly decreasing. The rate of growth of Internet use is currently two million new Internet users per month. More than half the nation is online and about two-thirds of the population use computers. Also, the rapid adoption of the Internet is occurring among most groups regardless of location, income, education, race/ethnicity, age, or gender. In particular, the groups that have traditionally been identified as the "have nots" are making extraordinary gains.

Despite these encouraging data, the digital divide still remains, or has expanded slightly for some groups. Blacks and Hispanics continue to experience the lowest household Internet penetration rates of any demographic group and, with respect to computer ownership, Black and Hispanic households have the lowest penetration rate. Individuals 50 years of age and older are among the least likely to use the Internet. Two-parent

households are nearly twice as likely to have Internet access as single-parent households. Also, people with a disability are only half as likely to have access to the Internet as those without a disability.

Several analysts question whether or not there is a digital divide. Because technology is so cheap, if not free, almost anyone can have access to the Internet. The real divide, some say, is not about access but relevance. Low literacy levels are a major hindrance, in addition to the more mundane tasks of using a mouse and working on a keyboard. Also, limited diversity of content geared to the interests of the disadvantaged is a significant barrier to getting lower income users online.

Many industry watchers argue that a "post-PC" era is set to dawn that will be characterized by numerous computing and communications alternatives. One analyst predicts that in another four years—or less than ten years since the Internet became generally available to households—we may find that more than two-thirds of all families are connected to the Internet at home. By contrast, 75 years elapsed between the invention of the telephone and its spread to two-thirds of American homes.

Focusing upon the institutional divide in higher education, there is substantial evidence to suggest that larger higher education institutions have a distinct advantage over smaller colleges and universities with regard to access to technology. This results in many more large institutions offering distance-education courses than smaller institutions. Moreover, large public and private universities have the best ratios of information technology staff to FTE students and spend more on technology than smaller institutions. These smaller institutions face several challenges, including: (1) lack of campus infrastructure; (2) lack of reliable middleware—security, authentication, and network management tools; and (3) lack of cooperation from telecommunication companies in providing service.

Theme III: Preparation for Using Technology

This theme targets the extent to which postsecondary education students are prepared to use technology. There is good evidence that the United States has come a long way since

1994 in providing computer and Internet access to students in public elementary and secondary schools. Ninety-eight percent of the schools enjoyed Internet access in 2000, regardless of the poverty concentration of the students, location, or level of the school. Also, 77 percent of classrooms are connected to the Internet. Yet, differences in school characteristics remain. About four out of five schools with low concentrations of poverty enjoyed Internet access in classrooms compared to 60 percent of schools with high concentrations of poverty. The ratio of students to instructional computers in public school had decreased to 5 to 1, which equals the ratio that many experts consider a reasonable level for the effective use of computers. The ratio per computer *with Internet access* was 7. But, again, differences remain. Schools with the highest concentration of poverty had 9 students per computer with Internet access, compared to 6 in schools with the lowest poverty concentration.

Making the Internet accessible outside of regular school hours allows students, who would not otherwise have the opportunity, to have access to the Internet for school-related activities like homework. In 2000, over half of public schools with access to the Internet reported that computers with access to the Internet were available to students outside of regular school hours. Secondary schools were more likely to provide this service than elementary schools. Moreover, schools with the highest minority enrollment provided Internet availability outside of regular school hours more frequently than schools with the lowest minority enrollment.

In 1999, virtually all full-time regular teachers in the nation's public elementary and secondary schools had access to computers or the Internet somewhere in their schools, and over one-third reported that they used computers or the Internet "a lot" to create instructional materials. Two of the major barriers teachers identified in using technology, were an insufficient number of computers and a lack of release time to learn how to use computers and the Internet. Teachers in schools with high poverty concentrations were about half as likely than teachers in schools with low poverty to use computers or the Internet a lot. Also, teachers in high poverty schools complain that outdated,

incompatible, or unreliable computers are a significant barrier to the effective use of computers.

In spite of the considerable amount of computers available to teachers in elementary and secondary schools, some analysts assert that since teachers are not trained to use technology or given opportunities to develop creative uses for technology, computers are merely used as glorified typewriters. Even teachers who become serious users of computers do not change their classroom practices.

Turning to computers in the home, in 2000, about two-thirds of all children 3 to 17 years of age lived in a household with a computer, and about one-third of all children used the Internet at home. Differences remain with regard to race. About two-thirds of White non-Hispanic and Asian and Pacific Islander children lived in households with computers, compared to 43 percent of Black children and 37 percent of Hispanic children. Also, over one-third of White non-Hispanic and Asian and Pacific Islander children used the Internet at home, while only 15 percent of Black and 13 percent of Hispanic children did so.

Focusing on college-age students, a survey of Fall 2000 college freshmen reveals that most are computer literate. About four out of five men and women freshmen reported using a personal computer frequently during the year prior to entering college. However, women freshmen were half as likely as men to rate their computer skills as above average or the top ten percent. Additionally, women freshmen reported that they were less likely than men to participate frequently in Internet chat rooms and less likely to report frequent Internet use for "other" reasons or activities.

Theme IV: Effectiveness of Technology in the Learning Process

This final theme looks at the effectiveness of technology in the learning process, with particular attention to distance learning, which is an area of inquiry that is somewhat elusive. The literature on this subject contains a plethora of references that conclude that technology-mediated distance learning compares favorably with on-campus classroom

instruction. Also, many other references find that students and faculty have a positive view of their distance education learning experience. However, an analysis of the literature on the effectiveness of technology-mediated distance learning reveals that it may be too early to reach these conclusions. Reviews of the body of literature on effectiveness reveal that much of the documents are how-to articles, advocacy pieces, and second-hand reports. Original research is in short supply, and those limited studies suffer from poor methodology, which renders their findings questionable. Some of major shortcomings of the research include the following:

- Most of the research does not control for extraneous variables, which made it difficult to identify cause and effect.
- Most of the studies do not use randomly selected subjects, which is the best way to control for extraneous variables.
- The reliability and validity of the instruments used to measure student outcomes and attitudes are questionable, which can render a lack of confidence in the findings.

There are also important gaps in the research on technology-mediated distance learning., including: (1) the dearth of studies dedicated to measuring the effectiveness of *total* academic programs—virtually all of the studies focus on individual courses; (2) the research does not adequately explain why the dropout rates of distance learners are so high; and (3) the effectiveness of "digital libraries" is not adequately addressed—there is some evidence that curricular objectives may be altered because of a limited variety of books and periodicals online.

The substandard research on the effectiveness of technology-mediated distance learning notwithstanding, it would be erroneous to come to the verdict that distance learning is not effective or of poor quality. These studies found fault with the *research on distance education*, not distance learning itself. There were well over 50,000 different distance education courses offered to over 1.5 million students in 1997-98, according to the best estimates. The vast majority of the institutions offering distance education courses are accredited and a substantial portion of faculty teaching distance education courses are

full-time regular faculty who are also teaching on-campus courses. It is also apparent that technology-mediated distance learning is evolving its own pedagogy, and with the introduction of more audio and video and broadband access, new and richer models can be explored.

Several organizations have developed standards and guidelines to ensure quality distance education, including the Southern Regional Electronic Campus, the National Education Association, and the Western Cooperative for Educational Telecommunications. A recent study, *Quality on the Line: Benchmarks for Success in Internet-Based Distance Education,* reviewed these guidelines and attempted to validate them through actual experience of institutions recognized among the leaders on distance education. Focusing specifically on Internet-based distance education, the report identified 24 benchmarks considered mandatory for quality distance education. The benchmarks covered areas such as course development, evaluation and assessment, faculty support, and institutional support.

The American Federation of Teachers (AFT) issued a report critical of distance education, outlining their concerned of the way distance education is being organized and conducted. Specifically, the AFT alleges that much of distance education is built on corporate ideas about consumer focus, product standardization, tight personnel control, and cost effectiveness, which are not consistent with the traditional model of higher education decision-making. Fourteen standards are advanced that address their concern and include key elements revolving around faculty independence in teaching and research and collegial decision making.

Concluding Remarks

This report attempts to address the nexus between access to higher education and technology. More specifically, how technology affects access to postsecondary education and how technology is used in postsecondary education. This framework engenders several fundamental questions. How has technology facilitated the opportunity for students to enroll in colleges and universities? Has technology enhanced the ability of

colleges to reach new and expanded constituencies? To what extent do postsecondary education students have access to technology-based learning? How are students prepared to use technology in postsecondary education? Finally, how effective is technology in the teaching-learning process?

For the most part, the literature has addressed these topics and much is known about access and technology. Yet, because of the dramatic pace of technology growth, information becomes old news very quickly. Thus, much of the data need to updated at regular intervals. The number of distance education courses and programs require continuous monitoring. The number and type of higher education institutions providing technology-mediated distance learning should be assessed again, particularly since many had plans to offer distance learning courses and programs. Looking at the broader picture, the issue of computer and Internet access in the general populace, the elementary and secondary schools and among higher education institutions needs persistent observation. Also, understanding the extent to which faculty in K-12 and higher education use computers and the Internet is an area that requires updating.

In addition to making sure that the data are current, several questions can be addressed that would expand our understanding of the relationship between technology and access to postsecondary education.

The following questions regarding preparation are pertinent.

- To what extent are teachers trained to use computers and access the Internet?
- Are the computers in the elementary and secondary schools up-to-date and maintained, and are there differences among communities?
- To what extent are teachers trained to use computers and access the Internet?
- Are teaching methods being altered because of the use of computers or are computers just another bell or whistle with little impact upon pedagogy?
- What are the barriers that inhibit students from using computers and the Internet?

Financial aid is another area of concern.

- To what extent are the Title IV requirements inhibiting the ability of students to participate in technology-mediated distance learning?
- How many students are not taking distance learning courses because of Title IV regulations?
- Are state financial aid requirements presenting barriers to distance education students and, if so, how?
- To what extent are students refraining from taking courses from more than one institution simultaneously because of financial aid restrictions?

Questions remain regarding the quality and effectiveness of distance education.

- How are colleges and universities assessing the effectiveness of their technology-mediated distance education courses?
- Are faculty and/or the institutions using different methods to determine effectiveness for distance education courses versus traditional classroom courses?
- To what extent are new models of teaching/learning being explored in higher education because of technology?

An essential component of good public policy is good and reliable information. Much has been written about the twin topics of technology and access to postsecondary education. However, because of the striking pace of technological advances and the proliferation of new players in the higher education community, the issues are like quicksilver and the landscape keeps shifting. Monitoring these phenomena requires continual vigilance through periodic data collection and informed analysis.

Introduction

The value of a college education, both to the individual and society in general, is evident. The earnings gap of Americans based on educational attainment is widening. For instance, from 1978 to 1998, inflation-adjusted annual earnings for persons with only a high school education actually declined by four percent, in contrast to those with bachelor's degrees whose earnings increased by 15 percent (U.S. Census Bureau, 1999). Also, those with associate and bachelor's degrees earn 29 percent and 73 percent more, respectively, than high school graduates over the course of their lifetimes. Increased educational attainment also accrues benefits to society, including greater productivity, increased charitable giving and community service, enhanced quality of civic life, and decreased reliance on government financial support (The Institute for Higher Education Policy, 1998).

Because knowledge-based economies require increasing levels of education and training, augmenting access to postsecondary education is an issue of significant importance to the nation. In the U.S., estimates of the proportion of future jobs requiring postsecondary education range from 70 to 90 percent (Gladieux, 1999). Even though U.S. higher education enrollments in postsecondary education are at record levels, virtually every state recognizes the need to expand access and increase enrollment in education and training programs after high school.

Compounding the issue of access is the role of technology. Particularly since 1990, when the coding for the World Wide Web was developed, the opportunities for students to participate in postsecondary education have increased considerably. Thousands of online courses are now available and more and more on-campus courses possess a technology component. Many colleges and universities are finding the Internet to be an effective tool for use with their admissions programs. In addition, education and training through the Internet is becoming big business worldwide.

These developments raise an important policy question. Does technology expand or serve as a barrier to access to postsecondary education, particularly to underrepresented groups? Put another way, has the advent of technology in our colleges and universities and other emerging postsecondary education providers helped or hindered the ability of certain classes of people—such as racial/ethnic and low income groups—from enjoying the benefits of education beyond high school? This public policy issue engenders other corollary questions. To what extent do higher education students have access to technology-based learning, including access to faculty, information, and other learning experiences? Does availability of computing resources or technology in secondary school affect access to postsecondary education? Indeed, how effective is technology in the learning process?

Because of the ever increasing pervasiveness of technology within the higher education community, and indeed all of education, these questions are becoming increasingly important. Thus, the National Postsecondary Education Cooperative (NPEC) identified the relationship of access to postsecondary education and the role of technology as an important strategic area for study. This report attempts to address this relationship. To do so, four themes have been developed to help frame the topic. They are: (1) access to postsecondary education—using technology; (2) access to technology-based learning; (3) preparation for using technology, and (4) effectiveness of technology in the learning process. Addressing each of these themes, interrelated in several respects, provides an extensive overview of technology and access to postsecondary education.

Theme I: Access to Postsecondary Education—Using Technology

This theme encompasses the degree to which technology has facilitated the opportunity for students to enroll in colleges and universities. What difference has technology made with regard to the ability of colleges to reach new or expanded constituencies? Also, are there any barriers that inhibit the ability of students to use technology when pursuing postsecondary education and training?

Distance Education Learners

To understand the breadth of the intended audience for technology-mediated distance learning[1], the American Council of Education, in cooperation with Educause, has identified the following sample set of learner segments (Oblinger, 2001). *Corporate learners* work for corporations and are seeking education to maintain or upgrade their skills. The purchasing decision is made by the employing corporation and not by the individual acting alone. *Professional enhancement learners* are seeking to advance their careers or shift careers. They are working adults who make the educational purchasing decision on their own. *Degree-completion adult learners* are working to complete a degree at an older age. They frequently are working adults who must balance work and family needs with their educational goals. *College experience learners* are preparing for life (the traditional student). This segment includes many of the 18-to-24-year-old residential college students for whom the coming of age process is almost as important as academic achievement.

Other sets of learners include *pre-college (K-12) learners* who are interested in doing postsecondary-level work prior to the completion of high school. This segment may be interested in getting a jump start on college. *Remediation and test preparation learners* are focused on learning as a prerequisite to an examination or enrollment in another program. Finally, *recreational learners* are interested in education for its own sake. They

[1] Technology-mediated distance learning involves activities where the learners are at a distance from the originator of the teaching material and a combination of media that may be used includes television, videotapes, videoconferencing, audioconferencing, e-mail, Internet, telephone, fax, and computer software.

enjoy learning and view additional education as a hobby or as a source of personal enjoyment.

Institutions Participating in Distance Education and Using Technology

This array of potential students has not been lost on the colleges and universities in the United States. It seems that new programs and courses are developed virtually (no pun intended) every day. The second edition of *Peterson's Guide to Distance Learning Programs*, published in 1998, includes programs from some 700 accredited North American institutions, in contrast to the first edition, published in 1994, where there was less than 100 institutions (Peterson's, 1998). Any hard cover publication listing distance education programs is out dated as soon as it hits the bookstores. Peterson's Web site, http://www.lifelonglearning.com, provides more updated information and shows that close to 3,600 academic programs are now available as the year 2002 begins.

The National Center for Education Statistics (NCES) surveyed a sample of all 2-year and 4-year postsecondary institutions and collected information for the 12-month 1997-98 academic year (Lewis, 1999). The following summary of the findings suggests that distance education is becoming an increasingly visible feature of the landscape of higher education.

- During 1997-98, thirty-four percent of all postsecondary education institutions offered distance education. The percentage of public 2-year institutions that offered distance education was 62 and the percentage for private 2-year institutions was 5. Seventy-eight percent of public 4-year institutions offered distance education, while only 19 percent of private 4-year institutions did the same. Larger institutions tended to offer distance education; 87 percent of institutions enrolling more than 10,000 students provided distance learning compared to 19 percent of institutions with less than 3,000 students.

- Another 20 percent of the institutions planned to offer distance education in the next three years, while 47 percent did not offer and did not plan to offer distance education courses in the next three years.

- It was estimated that 54,470 different distance education courses were offered in 1997-98.[2] Of these, 49,690 were college-level, credit-bearing courses, mostly at the undergraduate level (35,550). Public 2-year and 4-year colleges and universities accounted for 80 percent of the total distance education course offerings and 79 percent of the college level, credit-bearing courses.

- The report indicated that 8 percent of all postsecondary institutions offered a college-degree or certificate program that could be earned entirely through distance education. Degree programs were most prevalent at public 4-year institutions where 30 percent offered degrees through distance education. Eight percent of public 2-year institutions offered complete distance education programs, while 6 percent of private 4-year did so. Among the institutions offering distance education courses, one-fourth offered a degree or certificate that can be completed entirely through distance education.

- In 1997-98 there were approximately 1,661,100 enrollments in distance education courses.[3] Out of these, an estimated 1,363,670 (82 percent) were in college-level, credit-granting courses. Public 2-year institutions showed the largest enrollments with 714,160. Public 4-year colleges and universities were close behind with 711, 350. Enrollments in private 4-year institutions were 222,350.

- In examining the various technologies used in distance education, the report noted that 58 percent of postsecondary education institutions made use of asynchronous Internet instruction, which was the most widespread media for course delivery. Nineteen percent of institutions offered synchronous instruction over the Internet.

[2] Course offering data are unduplicated.
[3] Enrollment numbers are duplicated.

Fifty-four percent of institutions used two-way interactive video, and 47 percent used one-way prerecorded video.

The Internet is also influencing college admissions operations. In response to a December 2000 survey to the members of National Association for College Admission Counseling (NACAC) 100 percent of the responding institutions used their institutional Web site to present general and college admission information to prospective students. Ninety-five percent of the responding institutions used the Internet's electronic mail capability to respond to student inquiries. Eighty-six percent of the institutions reported the use of their Web site to permit students to download, complete and mail the admission application to the institution, while 75 percent reported that they allow students to complete their application online and transmit it electronically[4] (Burtnett, 2001).

A far more comprehensive survey of 1,392 colleges and universities supports these data (Green, 1999). The report, Campus Computing, 1999, found that more institutions are providing more services via their campus Web sites. In 1999, more that two-thirds (70.2 percent) of the 530 responding institutions offered online undergraduate applications, up from 55.4 percent in 1998. Three-fourths (76.9 percent) made the complete course catalog available on the campus Web site (up from 65.2 percent the year before), while almost a third (30.0 percent) offered online course registration, compared to 20.9 percent in 1998.

In General, Does Technology Increase Participation in Postsecondary Education?

Policy makers have asked if the availability of technology-mediated distance learning has increased participation in higher education. In a series of case studies to evaluate the benefits and costs of distance education, evidence suggests that distance learning efforts can increase the number of people enrolling in postsecondary education (Jewett, 1997a, b, c). For instance, at Rensselaer Polytechnic Institute, 75 percent of the respondents

[4] The reader should be cautioned that only 122 out of 966 (13 percent) recipients completed and returned the survey.

indicated that that they would not have been able to participate in a course if it had not been delivered to their workplace. In a cooperative program between SUNY Brockport and the SUNY Campuses in Western New York State, it was found that course sharing among campuses is a significant way to maintain degree programs and provide adequate course offerings even where campus departments are relatively small. Also, a study of a collaborative distance education program effort between Old Dominion University and community colleges in Virginia estimated that participation of Virginia residents in 4-year public higher education increased by over 4,000 individuals (a 3.3 percent increase in the participation rate).

It appears that there is some evidence that the introduction of technology can increase participation in postsecondary education. Later in this report, a more detailed analysis is provided to examine the extent to which there may be differences in participation rates of certain classes of people.

Financial Aid for Distance Education

The ability of technology-mediated distance learning to reach new constituencies notwithstanding, some note that the current structure of financial aid programs in the U.S. has proven to be a barrier to the ability of students to participate in distance education. Title IV of the Higher Education Act, which authorizes the majority of federal student aid programs, restricts access by institutions that enroll more than half their students or offer more than half their courses in distance education (commonly called the 50 percent rule). The regulations also stipulate an academic year of at least thirty weeks for students to be eligible for the maximum amount of federal grants and loans, and prohibits aid to distance education students for computers or living expenses. In addition, according to Gerald Heeger, the president of University of Maryland University College, the real value of the Internet is for a student to construct the program that best fits his or her needs, regardless of where the particular courses are offered. However, Heeger states that it is virtually impossible for a student to enroll in more than one higher education institution at the same time because of the financial aid regulations (Heeger, 2000).

The U.S. Congress, recognizing the importance of financial aid in determining access to higher education, mandated that the Department of Education create a pilot project that waives these regulations for some institutions and students. In July 1999 the department selected the first fifteen institutions to participate in the project (Heller, 2001). Ten more institutions have been added since then.

Responding to the pilot project, a group of colleges and universities in Colorado convened a roundtable to discuss key issues on financial aid for distance education students. The discussion resulted in the development of the following six principles for future policy development (The Institute for Higher Education Policy, 1999).

- Student aid should be available without regard to mode of instructional delivery.

- Delivery of student aid should be learner-centered, with aid following the student through the academic program.

- Aid should be awarded only to those in accredited programs of study that confer a recognized credential, such as a degree or certificate.

- The awarding of student aid should be tied primarily to standards of academic progress and not arbitrary measures of time.

- Regulations should give institutions flexibility in determining how to calculate eligibility for aid to pay for direct (tuition) and indirect (living expenses) cost of attendance.

- Aid amounts and limits should be focused more on lifetime standards than on annual or institutional maximums.

In October 2001 the U.S. House of Representatives passed a bill to curtail regulations that inhibit students from participating in distance education (Carnevale, 2001). The bill,

H.R. 1992, would, for some institutions, effectively eliminate the 50-percent rule and, also, change the 12-hour rule—which requires a student to spend at least 12 hours a week in a physical classroom to be eligible for federal financial aid. In place of the 12-hour rule, students would have to spend at least one day a week interacting with their professors, either face-to-face or at a distance. If the bill were to pass the Senate and be signed by President Bush, any institution that is currently providing federal financial aid could ignore the 50-percent rule, provided that its loan default rate has been below 10 percent during the previous three years. While many distance education administrators praise the bill, some faculty groups have criticized the measure, saying that the regulations ensure quality in education and that if the rules are rescinded, students could be defrauded by illegitimate operations. As of the date of this report, the bill is awaiting debate in the Senate.

Summary

It is increasingly clear that technology has expanded the ability of students to participate in postsecondary education. Virtually every type of learner identified by the American Council on Education can benefit because of technology, particularly the Internet. In addition to the rapid proliferation of new courses and programs, colleges and universities are taking advantage of the Internet to enhance the admissions process and giving potential students the opportunity to apply online. There is also evidence that technology is allowing students to participate in postsecondary education either in their home or workplace, a portion of which would not otherwise enroll in higher education. This is important because it suggests that increased participation is not necessarily a zero-sum game. That is, it appears that technology is opening up new markets of potential students without significantly diminishing the number of students who would enroll in traditional colleges and universities, many of which are offering technology-mediated distance education anyway.

Distance education advocates and others contend that a major barrier to the ability of technology to enhance access to postsecondary education is the student financial aid system, particularly Title IV of the Higher Education Act. Although Congress has

introduced legislation to ameliorate the barriers, concerns remain that loosening the restrictions will reintroduce the specter of fraudulent enterprises that plagued the Title IV program in the 1980s and early 1990s and resulted in unacceptable default rates.

Theme II. Access to Technology-Based Learning

This theme focuses on the extent to which postsecondary education students have access to technology-based learning. In particular, how has technology expanded access to faculty, information, and other learning experiences? Moreover, does access vary by characteristics such as race/ethnicity, age, gender and/or income?

The term "digital divide" can be a useful framework for this discussion. Digital divide refers to the perceived gap between those who have access to the latest technologies and those who do not. Underlying this concept is the notion that, since we are in the Information Age, those not having access to information are considered to be disadvantaged. Also, it is assumed that those who have access will further their distance from those who do not. The concept of digital divide achieved mass media attention when it became part of the title of the second National Telecommunications and Information Administration (NTIA) survey in 1998 (Compaine, 2001). Today the term has become part of the vernacular regarding technology "haves" and "have nots" and higher education.

There are several dimensions to the notion of digital divide. Without becoming overly complex, it is helpful to separate digital divide into two basic categories: *household and individual* digital divide—which refers to people, and *institutional* digital divide—which refers to colleges and universities. Before discussing these issues, it is important to caution that the accelerating pace of the Information Age makes it difficult to get up-to-date information. Things are changing rapidly and as this paper is being written, it is quite clear that some of the data may already be obsolete. Nevertheless, here is what is known so far.

Household and/or Individual Digital Divide

Throughout this section, *household and individual* digital divide is defined by the degree of access to (1) a computer and (2) an Internet connection. After exploring basic

information regarding households with computer and Internet access, more detailed analysis is be provided regarding various individual demographic characteristics.

Overall Digital "Inclusion"

The most recent and comprehensive data on this issue come from the latest of a series of reports by the National Telecommunications and Information Agency (NTIA). Titled, *A Nation Online: How Americans are Expanding Their Use of the Internet*, the report provides comprehensive information on Americans' connectivity to the Internet, broadband services, and computers (National Telecommunications and Information Agency, 2002). Using data from September, 2001, the report shows that in the last few years, Americans' use of the Internet and computers have grown substantially. Some of the major findings are as follows.

- The rate of growth of Internet use in the United States is currently two million new Internet users per month.

- More than half of the nation is now online. In September 2001, 143 million Americans (about 54 percent of the population) were using the Internet—an increase of 26 million in 13 months. In September 2001, 174 million people (or 66 percent of the population) in the United States used computers.

- Children and teenagers use computers and the Internet more than any other age group with 90 percent of children between the ages of 5 and 17 (or 48 million) now using computers.

- Computers at schools substantially narrow the gap in computer usage rates for children from high and low income families.

- Between August 2000 and September 2001, residential use of high-speed, broadband service doubled—from about 5 to 11 percent of all individuals, and from 11 to 20 percent of Internet users.

The rapid adoption of the Internet is occurring among most groups of Americans, regardless of location, income, education, race/ethnicity, age, or gender, according to another recent report by the NTIA (National Telecommunications and Information Agency, 2000). Indeed, groups that have traditionally been digital "have nots" are making dramatic gains.

- *Location:* The gap between households in rural areas and households nationwide that access Internet has narrowed from 4 percentage points in 1998 to 2.6 percentage points in 2000. Rural households moved closer to the nationwide Internet penetration rate of 41.5 percent. In rural areas, 38.9 percent of the households have Internet access, a 75 percent increase from 22.2 percent in December 1998.

- *Income:* Americans at every income level are connecting at far higher rates from their homes, particularly at the middle income levels. Internet access among households earning $35,000 to $49,000 rose from 29 percent in December 1998 to 46.1 percent in August 2000. More than two-thirds of all households earning more than $50,000 have Internet connections.

- *Education:* Internet connectivity is expanding across every education level, particularly for those with some high school or college education. Households headed by someone with "some college experience" showed the greatest expansion in Internet penetration of all education levels, rising from 30.2 percent in December 1998 to 49 percent in 2000.

- *Gender:* The disparity in Internet usage between men and women has largely vanished. In December 1998, 34.2 percent of men and 31.4 percent of women were using the Internet. By August 2000, 44.6 percent of men and 44.2 percent of women were Internet users.

- *Age:* Individuals 50 years of age and older—while still less likely than younger Americans to use the Internet—experienced the highest rates of growth in Internet

usage of all age groups: 53 percent from December 1998 to August 2000, compared to 36 percent growth rate for individual Internet usage nationwide.

- *Race:* While Blacks and Hispanics still lag behind other groups, they have shown significant gains in Internet access. Black households are more than twice as likely to have home access than they were, rising from 11.2 percent in December 1998 to 23.5 percent in August 2000. Hispanic households have also experienced an impressive growth rate during the same period, rising from 12.6 percent to 23.6 percent.

Digital Divides Still Exist

In spite of these encouraging data, the digital divide still remains or has expanded slightly in some cases, even while Internet access and computer ownership are rising rapidly for almost all groups. The data for August 2000 from the NTIA study show that divides still exist between different racial and ethnic groups, old and young, single and dual-parent families, and those with and without disabilities.

- *Race and Ethnicity.* While Asian Americans and Pacific Islanders have maintained the highest level of home Internet access at 56.8 percent, Blacks and Hispanics, at the other end of the spectrum, continue to experience the lowest household Internet penetration rates at 23.5 percent and 23.6 percent respectively. When measured against the national average, Blacks and Hispanics do not compare favorably. The divide between Internet access rates for Black households and the national average rate was 18 percentage points in August 2000 (a 23.5 percent penetration rate for Black households, compared to 41.5 percent for households nationally). That gap is 3 percentage points wider than the 15 percentage point gap that existed in 1998. The Internet divide between Hispanic households and the national average rate was virtually the same and the gap was 4 percentage points wider than what existed in December 1998. With respect to individuals, while about a third of the U.S. population uses the Internet at home, only 16.1 percent of Hispanics and 18.9 percent of Blacks use the Internet at home.

With regard to computer ownership, the divide seems to have stabilized, although it remains large. The divide between Black households and the national average in August 2000 was 18 percentage points (a 32.6 percent penetration rate for Black households, compared to 51 percent for households nationally). That gap is statistically no different from the gap that existed in December 1998. Similarly, the 17 percentage point difference between the share of Hispanic households with a computer (33.7 percent) and the national average (51 percent) did not register a statistically significant change from the December 1998 computer divide.

- *Age.* Individuals 50 years of age and older are among the least likely to be Internet users. The Internet use rate for this group was only 29.6 percent in 2000. It is interesting to note that individuals in this age group were almost three times as likely to be Internet users if they were in the labor force than if they were not.

- *Two-parent and single-parent households.* Two-parent households are nearly twice as likely to have Internet access as single-parent households (60.6 percent for dual-parent, compared to 35.7 percent for male-headed households and 30 percent for female-headed households).

- *Disability.* People with a disability are only half as likely to have access to the Internet as those without a disability: 21.6 percent compared to 42.1 percent. While just under 25 percent of people without a disability have never used a personal computer, close to 60 percent of people with a disability fall into that category. Among people with a disability, those who have impaired vision and problems with manual dexterity have even lower rates of Internet access and are less likely to use a computer regularly than people with hearing difficulties.

  Help may be on the way for people with disabilities. The official start date of compliance for Section 508 of the Rehabilitation Act is June 21, 2001. The Act requires Federal agencies to take into account the disability access features of products and services that the agencies procure. The accessibility requirements

extend to the Web as well as hardware, software, and other electronic information technologies. The question of the applicability of Section 508 to colleges and universities is difficult to answer. Some argue that higher education institutions must comply with Section 508 because of the Assistive Technology Act of 1998, which supplies funds to states on condition of compliance with Section 508 rules and regulations. Yet, even if this interpretation is accepted, Section 508 is a procurement law, and might not apply to Web content developed at the institution. Also, a state could, in theory, refuse the monies from the Assistive Technology Act, and thus exempt it from compliance to Section 508. Nevertheless, higher education institutions are still bound by the Americans with Disabilities Act of 1990 and Section 504 of the Rehabilitation Act. Both of these laws require equal access for people with disabilities (Bohman, 2001).

Massaging the Numbers

In a study conducted in December 1999 based on data from a panel of households recruited as a random telephone sample of the U.S. population, Norman H. Nie and Lutz Edbring explored the myth or reality of the digital divide (Compaine, 2000). Among their conclusions, they found that 21 percent of differences in Internet access can be explained by demographic factors. According to the authors, by far the most important factors facilitating or inhibiting Internet access are education and age, and not income, nor race/ethnicity or gender, each of which account for less than 5 percent change in rates of access and are statistically insignificant. In contrast, a college education boosts rates of Internet access by well over 40 percentage points compared to the least educated group. Also, people over 65 show a more than 40-percentage-point drop in rates of Internet access compared to those under 25. Age really reflects generational differences, and thus shows what to expect in the future.

The authors also conclude that once people are connected to the Internet they hardly differ in how much they use it and what they use it for—except for a drop-off after age 65, and a faint hint of a gender gap. Internet use increases dramatically, both in terms of amount of time and in terms of range of activities, the longer people have been connected

to the Internet. The activities include (1) communication (sending and receiving e-mail), (2) accessing information, (3) having fun, and (4) shopping.

Behind the Numbers

It is instructive to review some of the interpretations regarding the digital divide. Several commentators suggest that there is no digital divide crisis in the United States. Hassan Fattah (2000) argues that if Americans really want a personal computer and access to the Internet, they can obtain them at very little cost. Technology is getting so cheap, if not free, that almost anyone can have access to the Internet. Thus, access to computers alone is an incomplete measure of the digital divide. A growing chorus of community activists and educators are warning that the real divide is not about access but relevance. A different message needs to be sent about technology and its usefulness in people's daily lives. In addition, low literacy levels is a significant hindrance. Working on a keyboard can be a major hurdle and manipulating a mouse can be daunting for many. Further exacerbating the problem is the lack of online content tailored to the disadvantaged. In short, the dearth of pertinent information, literacy barriers, and limited diversity of content are the biggest barriers to getting lower income users online.

Adam Thierer (2000) echoes these sentiments. He notes that, "even if obtaining the 'free PCs' requires some minimal fee to lease a system for an extended period of time, Americans are still able to afford these systems. Skeptics who argue otherwise should consider: How is it that the average television set today costs more than an entry-level PC, yet according to the federal government's own data, almost every American home has a television?" Many industry watchers argue that a "post-PC" era is set to dawn that will be characterized by numerous computing and communications alternatives. He concluded that expensive federal entitlement programs will not facilitate this process; in fact, they could make things worse by putting pressure on computer prices to hold steady or increase.

Another perspective from an economist reinforces these views. Robert Crandall (2000) of the Brookings Institution argues that it is hardly clear that there is a digital divide that

needs immediate bridging through a deliberate public policy. By examining the determinants of household PC demand in 1994, and using the results to predict the diffusion of PCs in 1998, he found that the 1994 equation substantially under-predicted the diffusion of PCs among poor households and among Blank and Hispanic households. He predicts that in another four years, or less than ten years since the Internet became generally available to households, we may find that more than two-thirds of all families are connected to the Internet at home. By contrast, the author notes that 75 years elapsed between the invention of the telephone and its spread to two-thirds of American homes. The "analogue divide" was much more difficult to bridge than the digital divide!

A survey by the Pew Internet and American Life Project identified some interesting information regarding the group of people, called the "Nevers," who indicated that they definitely will not go online (Lenhart, 2000). Fully 81 percent of the Nevers are over 50 years of age, and when asked their opinion of the Internet, they were the most unenthusiastic about the Internet of those surveyed. Nevers are strong backers of the view that the Internet is dangerous (52 percent agreed with that thought), hard to use (33 percent agreed and 42 percent say they don't know) and expensive (32 percent agreed and 51 percent didn't know).

In contrast, the "Eagers" are that group of people who are without Internet access and say they will definitely or probably will go online. This cohort is weighted a bit towards women, Hispanics, and Blacks. Compared to the Nevers, Eagers have the largest proportion of those with relatively high household incomes, and those with relatively high levels of education. Most Eagers are young. About 65 percent of those under age 30 who do not have Internet access say that they want to get it. Finally, many of the Eagers have some experience with college. More than half of those with college degrees or with some college experience who are not online say they want to use the Internet. By comparison, just 27 percent of those without high school diplomas say they want to go online.

Institutional Digital Divide

Institutional digital divide pertains to the perceived gap between institutions who have access to the latest technologies and those institutions who do not. Educause (2000), in its report to the President's Information Technology Advisory Committee, asserted that the Federal information technology investment in higher education has resulted in a network capability at the largest universities that far outpaces that of other four-year degree-granting institutions. These smaller institutions, which enroll the great majority of college students, face severe challenges in meeting the advanced networking requirements necessary to educate the 21st century student. The report identifies the following obstacles from a technological perspective.

- Lack of campus infrastructure.

- Lack of reliable middleware (security, authentication, and network management tools).

- Lack of cooperation from telecommunication companies in providing service.

Other significant obstacles, other than technological, to advanced network deployment include the following.

- A difficult economic environment for information technology and networking at smaller institutions because advanced networking is often a new budgetary item.

- Lack of high level support from campus decision-makers.

- A return-on-investment that is difficult to articulate.

- Difficulty recruiting and retaining information technology staff.

A more recent report by the Institute for Higher Education Policy reinforces the conclusions offered by Educause by noting that there are gaps in access to technology capital among different types of institutions (Phipps and Wellman, 2001). Large, well-financed institutions simply have greater access to information technology funding than do smaller colleges with fewer resources. Citing U. S. Department of Education studies, the report draws attention to the fact that larger institutions are more likely to offer distance education than smaller colleges: 87 percent of institutions with more than 10,000 students offered distance-based classes, in contrast to only 19 percent of institutions with fewer than 3,000 students.

One could argue that differences in institution's approaches to distance learning may be the result of simple institutional choice rather than a lack of funding. Yet, research by Kenneth Green (2000) reveals disparities between research universities and teaching institutions that probably reflect resource differences more than institutional choices. Public and private research universities have the best ratios of information technology staff to full-time equivalent (FTE) students; are most likely to offer admissions, financial aid, course registration and library resources over the Interet; and have off-campus, dial-up Internet services for students and faculty.

A survey of mostly four-year institutions that do not offer doctorates provides more evidence of a digital divide (Olson, 2001). The data from the Cost of Supporting Technology Services project (COST) shows for 2000-2001, the median spending on information technology was $1,299 for each student and employee at the most selective and wealthiest liberal-arts colleges taking part in the study. By contrast, the less selective and less endowed undergraduate colleges showed a median spending of only $459 per student, professor, or staff member. The disparity between the two groups in median spending per user increased from $747 in 2000 to $840 in 2001.

A very recent study by the U.S. Department of Education, due to be published in March 2002, hints at institutional digital divide. The findings of the report are based on a nationally representative sample from the 1999 National Study of Postsecondary Faculty

(NSOPF:99) of instructional faculty and staff who taught one or more classes for credit Among the conclusions, the study found that the type of institution was shown repeatedly to be a key factor for access to technology. "In particular, those postsecondary instructional faculty and staff at 4-year doctoral institutions were significantly more likely to use e-mail and course-specific Web sites than those at 4-year nondoctoral or 2-year institutions." (Wharburton and Chen, 2002).

Although dated, a survey during the 1995-96 academic year of Hispanic-Serving Institutions (HSIs) reveals that fewer than one-half of students had institutional access to the Internet. Moreover, a review of Websites at HSIs indicated that outside the computer science department, the Internet was little used as a teaching tool by faculty. Most professors were reluctant to embrace the Internet and its associated technology. Finally, there was a critical need for regular training and support of faculty on the use of technology and adapting it to enrich their curriculum (Rodriguiz, Gonzalez, and Cano, 1996).

Summary

The evidence regarding whether or not there is a digital divide for households and individuals is somewhat mixed. On one hand, recent data suggests that the overall level of a digital divide in the United States is rapidly decreasing. More than half the nation is online and about two-thirds of the population use computers. Internet users increase by two million a month. Moreover, the rapid adoption of the Internet is occurring among most groups regardless of location, income, education, race/ethnicity, age, or gender. In particular, the groups that have traditionally been identified as the "have nots" are making extraordinary gains.

Although these data are encouraging, the digital divide still remains, or has expanded slightly for some groups. Blacks and Hispanics continue to experience the lowest household Internet penetration rates of any demographic group. In fact, the gap between access to the Internet for Black and Hispanic households and the national average access rate widened from 1998 to 2000. Also, with respect to computer ownership, Black and

Hispanic households have the lowest penetration rate. Individuals 50 years of age and older continue to be the least likely to be Internet users. Two-parent households have a much higher rate of Internet access than single-parent households. Finally, people with a disability are only half as likely to have access to the Internet as those without a disability. Some researchers have concluded that the most important factors facilitating or inhibiting Internet access are education and age. A college education increases rates of Internet access by over 40 percent compared to the least educated group and people over 65 show a more than 40-percentage-point drop in rates of Internet usage compared to those under 25.

These data notwithstanding, several analysts question whether or not there is a digital divide. Because technology is so cheap, if not free, almost anyone can have access to the Internet. The real divide, some say, is not about access but relevance. Low literacy levels are a major hindrance, in addition to the more mundane tasks of using a mouse and working on a keyboard. Literacy barriers, and limited diversity of content geared to the interests of the disadvantaged are significant barriers to getting lower income users online. Also, many observers claim that a "post-PC" era is set to dawn that will be characterized by many computing and communications alternatives. Another analyst suggests that in less than ten years since the Internet became generally available to households, we may find that more than two-thirds of all families will be connected to the Internet at home. In contrast, seventy-five years elapsed between the invention of the telephone and its spread to two-thirds of American homes.

Focusing upon the institutional divide, there is substantial evidence to suggest that larger higher education institutions have a distinct advantage over smaller colleges and universities with regard to access to technology. This results in many more large institutions offering distance-education courses than smaller institutions. Moreover, large public and private universities have the best ratios of information technology staff to FTE students; are most likely to offer admissions, financial aid, course registration, and library resources over the Internet; and have off-campus dial-up Internet services for students and faculty. A study of mostly four-year institutions that do not offer doctorates reveals

that the median spending on technology for each student and employee at the most selective and wealthiest liberal arts colleges was almost three times more than that of the less selective and less endowed undergraduate colleges--$1,299 to $459 respectively. Finally, a very recent study by the U.S. Department of Education found that instructional faculty and staff at four-year doctoral institutions were much more likely to use e-mail and course specific Web sites than those at four-year nondoctoral or two-year institutions.

Theme III: Preparation for Using Technology

This theme targets the extent to which postsecondary education students are prepared to use technology. What exposure to technology have students had prior to participating in higher education? What are the characteristics of students who are prepared to use technology? These questions will be the focus of this section.

Internet Access in U.S. Public Schools and Classrooms

A fundamental question regarding students' preparation for using technology during their postsecondary education experience is the degree to which they are exposed to computers and the Internet while attending K-12. The National Center for Education Statistics (2000a) has been tracking these data since 1994, when the White House's National Information Infrastructure (NII) initiative challenged the nation's schools and classrooms to connect to the Internet by the year 2000. The most recent survey indicates that the percentage of public schools connected to the Internet has increased each year, from 35 percent in 1994 to 98 percent in the fall of 2000. It is important to note that by 2000, all schools, regardless of level, poverty concentration, and metropolitan status, were equally likely to have Internet access

Looking at classrooms within schools, in 1994, only 3 percent of U.S. public school instructional rooms were Internet connected. By 2000, 77 percent were connected. In this case, however, differences by school characteristics remain. Sixty percent of classrooms had Internet access in schools with high concentrations of poverty (75 percent or more students eligible for free or reduced–price lunches), compared to 77 to 82 percent of classrooms in schools with lower concentrations of poverty. A similar pattern was evident by minority enrollment. Schools with the highest minority enrollment (50 percent or more) showed a smaller percentage of instructional rooms with Internet access (64 percent) than schools with lower minority enrollment (79 to 85 percent of instructional rooms). These continuing differences notwithstanding , the percentage of instructional rooms with Internet access increased between 1999 and 2000 in these

schools: from 38 to 60 percent in schools with the highest concentration of poverty, and from 43 to 64 percent in schools with the highest minority enrollment.

Another measure of students' access to technology is the ratio of students per computer. In 2000, the ratio of students per instructional computer in public schools was 5, which equals the ratio many experts consider a reasonable level for the effective use of computer s within schools. The ratio of students per instructional computer *with Internet access* decreased from 9 to 7 from 1999 to 2000. Again, differences remain across schools with different characteristics. For instance, schools with the highest concentration of poverty had 9 students per instructional computer with Internet access, compared to 6 among schools with the lowest poverty.

Making the Internet accessible outside of regular school hours allows students, who would not otherwise have the opportunity, to have access to the Internet for school-related activities like homework. In 2000, over half (54 percent) of public schools with access to the Internet reported that computers with access to the Internet were available to students outside of regular school hours. Secondary schools were more likely to provide this service than elementary schools (80 percent compared to 46 percent). Moreover, schools with the highest minority enrollment provided Internet availability outside of regular school hours more frequently than schools with the lowest minority enrollment (61 percent to 46 percent).

Teacher Use of Computers and the Internet

Computer availability is, of course, essential. However, the degree to which computers are used in the instructional process is perhaps even more important. This issue has also been addressed by the National Center for Educational Statistics (2000b), which commissioned a survey in the spring of 1999. The survey found that 99 percent of full-time regular public school teachers had access to computers or the Internet somewhere in their schools. Thirty-nine percent of the teachers with access to computers or the Internet indicated they used computers or the Internet "a lot" to create instructional materials, while less than 10 percent reported using computers or the Internet to access model

lesson plans or to access research and best practices for teaching. Newer teachers were more likely to use computers or the Internet to accomplish various teaching objectives.

Teachers' use of computers or the Internet at school varied for some types of uses by school poverty level. Teachers in schools with a school poverty level of less than 11 percent were more likely to use computers or the Internet "a lot" for creating instructional materials (54 percent) than teachers in schools with a school poverty concentration of 71 percent or more (32 percent). Moreover, teachers in schools with the lower minority enrollments were more likely to have the Internet available in the classroom than teachers in schools with the highest minority enrollments.

Two-thirds of public school teachers reported using computers or the Internet for instruction during class time, while 41 percent of teachers reported assigning students work that involved computer applications such as word processing and spreadsheets to a moderate or large extent. Almost one-third (30 percent) reported assigning research using the Internet to a moderate or large extent. Elementary school teachers were more likely than secondary school teachers to assign students practice drills using computers (39 versus 12 percent) and to require their students to use computers or the Internet to solve problems (31 versus 20 percent). Secondary school teachers were more likely to assign research using the Internet (41 versus 25 percent). Teachers in schools with the lowest poverty level were more likely to assign students work involving computer applications, research using CD-ROMs, and research using the Internet to a moderate or large extent than teachers in the highest poverty schools.

Barriers to Teachers' Use of Technology

Classroom and school characteristics, such as equipment, time, and technical assistance, may be barriers or facilitators for using technology. The following barriers have been identified in a study assessing teachers' use of technology (Smerdon, et. al., 2000).

- In 1999, those barriers most frequently reported by teachers to be "great" barriers to their use of computers or the Internet for instruction were an insufficient number of computers and lack of release time to learn how to use computers or the Internet.

- Secondary teachers, teachers in large schools, and teachers in city schools were more likely than elementary teachers, teachers in small schools, and teachers in rural schools to report that not enough computers was a great barrier. Also, teachers in schools with more than 50 percent minority enrollments were more likely to cite outdated, incompatible, or unreliable computers as a great barrier than teachers in schools with less than 6 percent minority students.

- As would be expected, teachers who reported insufficient numbers of computers as a great barrier were less likely than teachers reporting that this was not a barrier to assign students to use computers or the Internet to a "large extent."

In his provocative book, *Oversold & Underused: Computers in the Classroom*, Larry Cuban (2001) argues that teachers are not trained to use new technology or given a chance to develop creative uses for it in school. Thus, computers end up being merely souped-up typewriters. Teachers and students use the new technologies more at home than in the classroom and most classroom use is unimaginative. He concludes the following:

- Abundant availability of "hard" infrastructure (wiring, machines, software) and "soft" infrastructure (technical support, professional development) in schools in the late 1990s has not led, as expected, to frequent or extensive teacher use of technologies for tradition-altering classroom instruction.

- Students and teachers use computers and other technologies more at home than at school.

- When a small percentage of teachers using computers do become serious or occasional users, they—contrary to expectations—largely maintain existing classroom practices rather than change customary practices.

Other tend to agree with the above analysis. In an article in *Education Week on the Web* (2001), the proposition is put forth that inequities involve not so much access to computers, but the way computers are used to educate children. Although Internet access is no longer reserved just for schools in middle-class or wealth communities, many questions remain to be answered. "How often are students using the Internet and other computer resources to learn, and for what purposes? Are youngsters using school computers that can handle large amounts of data and employ sophisticated communication tools? Or are they working with obsolete machines that belong in a junkyard rather than a 21st century classroom? Other questions add to the complexity of the issue. Do some schools have the technical support necessary to keep machines running while others do not? Are teachers in one district getting better training to understand how to use technology to enhance learning, while teachers in another district are left to themselves to figure it out? And lastly, do all kinds of students—low achievers and high achievers, minority and white student, girls and boys, well-to-do and poor youngsters—benefit equally from the technology available in schools?"

Computers at Home

To what extent do children have access to computers in their home? This question is addressed from data collected from a Current Population Survey of the U.S. Census Bureau (Newburger, 2001). Sixty-five percent of all children 3 to 17 lived in a household with a computer in 2000, up from 55 percent in 1998. Almost one-third (30 percent) of all children used the Internet at home, compared to just 19 percent in 1998. Girls were as likely as boys to use the Internet at home, yet children's Internet use varied with age. Only 7 percent of the youngest children, those 3 to 5 years, used the Internet at home, while 48 percent of children 12 to 17 years used the Internet at home.

White non-Hispanic children are more likely to have access to a computer at home or use the Internet than are Black or Hispanic children. Among children 3 to 17 years of age, over three-fourths (77 percent) of White non-Hispanic and 72 percent of Asians and Pacific Islanders lived in households with computers, compared to only 43 percent of Black children and 37 percent of Hispanic children. While 38 percent of White non-Hispanic children and 35 percent of Asian and Pacific Islander children used the Internet at home, only 15 percent of Black children and 13 percent of Hispanic children did.

College Freshmen

The Cooperative Institutional Research Program (CIRP) has been surveying college and university freshmen for thirty-five years. The principal purpose of the CIRP is to assess the effects of college on students (Sax, et. al., 2000). An overview of the 2000 freshmen norms show that student use of personal computers has escalated in recent years. A record 78.5 percent of college freshmen report using a personal computer frequently during the year prior to entering college, up from 68.4 percent last year and 27.3 percent when this question was introduced in 1985. Also, the gender gap in use has nearly closed, with 77.8 percent of women and 79.5 percent of men indicating frequent use of computers in 2000.

Although the gender gap in use is closing, a new survey item suggests that women lag far behind men when asked about their computing self-confidence. Women are half as likely as men are to rate their computer skills as "above average" or "top 10 percent" relative to people their age (23.2 percent among women, versus 46.4 percent among men). This gap in self-confidence may contribute to the fact that men are five times more likely than women are to pursue careers in computer programming. With regard to the Internet, women are less likely than men are to participate frequently in Internet chat rooms and less likely to report frequent Internet use for "other" reasons or activities.

It is important to note that community colleges are not included in the CIRP. Since nearly all community college students live at home and the majority are employed, issues

of access to computers may be different for them—and for other commuter students who are employed—than for residential students.

Summary

The United States has come a long way since 1994 in providing computer and Internet access to students in public elementary and secondary schools. Ninety-eight percent of the schools enjoyed Internet access in 2000, regardless of the poverty concentration of the students, location, or level of the school. Also, 77 percent of classrooms are connected to the Internet. Yet, differences in school characteristics remain. About four out of five schools with low concentrations of poverty enjoyed Internet access in classrooms compared to 60 percent of schools with high concentrations of poverty. By the fall of 2000, the ratio of students to instructional computers in public school had decreased to 5 to 1, which equals the ratio that many experts consider a reasonable level for the effective use of computers. The ratio per computer *with Internet access* was 7. But, again, differences remain. Schools with the highest concentration of poverty had 9 students per computer with Internet access, compared to 6 in schools with the lowest poverty concentration.

Making the Internet accessible outside of regular school hours allows students , who would not otherwise have the opportunity, to have access to the Internet for school-related activities like homework. In 2000, over half of public schools with access to the Internet reported that computers with access to the Internet were available to students outside of regular school hours. Secondary schools were more likely to provide this service than elementary schools. Also, schools with the highest minority enrollment provided Internet availability outside of regular school hours more frequently than schools with the lowest minority enrollment.

In 1999, virtually all full-time regular teachers in the nation's public elementary and secondary schools had access to computers or the Internet somewhere in their schools, and over one-third reported that they used computers or the Internet "a lot" to create instructional materials. However, teachers in schools with high poverty concentrations

were about half as likely than teachers in schools with low poverty to use computers or the Internet a lot. Barriers identified by teachers to using computers or the Internet for instruction include an insufficient number of computers and lack of release time for teachers to learn how to use computers or the Internet. Moreover, teachers in high poverty schools complain that outdated, incompatible, or unreliable computers are a significant barrier to the effective use of computers.

In spite of the considerable amount of computers available to teachers in elementary and secondary schools, some commentators suggest—or state unequivocally—that since teachers are not trained to use technology or given opportunities to develop creative uses for technology, computers are used as glorified typewriters. Even teachers who become serious users of computers do not change their classroom practices. Several questions remain. How often do students really use computers and the Internet and for what purpose? Are the computers in the schools up-to-date? Do the schools have the appropriate technical staff to maintain new technology? Also, do teachers have sufficient training to use computers and the Internet effectively?

Turning to computers in the home, in 2000, about two-thirds of all children 3 to 17 years of age lived in a household with a computer, and about one-third of all children used the Internet at home. Girls were as likely as boys to use the Internet at home. Differences remain with regard to race. About two-thirds of White non-Hispanic and Asian and Pacific Islander children lived in households with computers, compared to 43 percent of Black children and 37 percent of Hispanic children. Also, over one-third of White non-Hispanic and Asian and Pacific Islander children used the Internet at home, while only 15 percent of Black and 13 percent of Hispanic children did so.

A survey of Fall 2000 college freshmen reveals that most are computer literate. About four out of five men and women freshmen reported using a personal computer frequently during the year prior to entering college. However, women freshmen were half as likely as men to rate their computer skills as above average or the top ten percent. Additionally, women freshmen reported that they were less likely than men to participate frequently in

Internet chat rooms and less likely to report frequent Internet use for “other” reasons or activities.

Theme IV: Effectiveness of Technology in the Learning Process

This final theme looks at the effectiveness of technology in the learning process, with particular attention to distance learning. Many studies have been conducted comparing the effectiveness of one delivery system over another—traditional classroom instruction versus technology-mediated distance learning. Other research includes case studies and descriptive studies that attempt to explain experiences of faculty and students participating in distance education courses. What have we learned from this research? Is technology-mediated distance learning effective, and, if so, how? These are the questions that frame this section.

The Institute for Higher Education Policy explored this issue by reviewing the available evidence related to the quality and effectiveness of distance education published since 1990, including everything from original research to policy papers to how-to articles. The study focused upon the validity of the research and gaps, if any, in the research literature (Phipps and Merisotis, 1999). The following paragraphs summarize the Institute's findings.

Contrary to what might be expected, the majority of what has been written about distance learning are opinion pieces, how-to prescriptions, and second-hand reports. Since determining the effectiveness of distance learning was the major interest, the Institute targeted its inquiry on original research, including experimental, descriptive, correlational, and case studies.

A major conclusion of the report was that there is a relative paucity of original research dedicated to explaining or predicting phenomenon related to distance learning. From the limited original research that was available, three broad measures of the effectiveness of distance learning were usually examined.

- Student outcomes, such as grades and test scores.

- Student attitudes about learning through distance education.

- Overall student satisfaction toward distance learning.

The vast majority of these studies concluded that, regardless of the technology used, distance-learning courses compared favorably with traditional classroom instruction. For example, several experimental studies suggested that distance-learning students had similar grades or test scores, or had the same attitudes toward the course as those students in campus-based courses. Case studies and descriptive analyses focused on student and faculty attitudes and perceptions of distance learning, and typically concluded that students and faculty have a positive view toward distance learning. In short, the published research strongly suggests that technology-mediated distance learning is effective.

A closer look at the research, however, suggests it may be premature to accept these findings at face value. Fundamentally, the overall quality of the research is questionable, which renders the findings inconclusive. Assessing the quality of original research requires a determination that the studies adhered to commonly accepted principles of good research. The analysis is much more than an academic exercise. These principles are essential if the results of the study are to be considered valid and generalizable. If a study does not comply with these principles, the results can be misleading or erroneous, and thereby lead to conclusions that result in poor public policy.

Some of the key shortcomings of the research included the following.

- **Most of the research did not control for extraneous variables.** Most experimental studies of distance learning are designed to measure how a specific technology (the "cause") impacts upon some type of learning outcome or influences student attitudes toward a course (the "effect"). To assess this relationship accurately, other potential "causes" must not influence the measured outcomes. But, in virtually all of the experimental studies, there was inadequate control of extraneous variables. Thus, it

was often impossible to rule out differences other than the technology as the "causal agents."

- **Most of the studies did not use randomly selected subjects.** The best way of controlling for extraneous variables is to assign students randomly to both the experimental and control groups. Most of the published studies reviewed, however, used intact groups for comparison purposes. Thus, the studies run the substantial risk of having a number of variables—such as student characteristics, time-on-task, instructional design—affect academic achievement or student satisfaction, not just the technology used to provide the education at a distance.

- **The reliability and validity of the instruments used to measure student outcomes and attitudes were questionable.** An important component of good educational research is the proper measurement of learning outcomes and/or student outcomes. A well-conducted study should include evidence of the validity and reliability of the measurement instruments—final examinations, quizzes, questionnaires, attitude scales—so that the reader can have confidence in the results. In almost all of the studies, this information was lacking.

There were also many gaps in the research concerning technology-mediated distance learning that were identified, including the following.

- **The research targeted student outcomes for individual courses rather than for total academic programs.** Perhaps the most significant gap in the research was the dearth of studies dedicated to measuring the effectiveness of total academic programs. This raises serious questions about whether a total academic program delivered by technology compares favorably with a program provided on campus. This is especially important since public policy is typically directed toward provided access to degrees or programs of study, not just a single course.

- **The research did not adequately explain why the dropout rates of distance learners are high.** A number of studies revealed that higher percentages of students who participated in distance learning courses dropped out before the course was completed compared to students in conventional classrooms. The issue of student persistence is particularly troubling because of the negative consequences associated with dropping out and because the research often excluded these dropouts, thereby tilting the student outcome findings toward only those that completed the course and were, therefore, "successful."

- **The effectiveness of "digital libraries" was not adequately addressed in the research.** Some digital libraries boast an enormous array of resources, with the implicit notion that they can provide the same service as the traditional library. Yet, do these libraries provide the necessary support of the academic programs? Anecdotal evidence seems to suggest that the curricular objectives of some distance learning courses may have been altered because of a limited variety of books, journals, and other resources online.

The study concluded the following. "Technology is having, and will continue to have, a profound impact on colleges and universities in America and around the globe. Distance learning, which was once a poor and often unwelcome stepchild within the academic community, is becoming increasingly more visible as a part of the higher education family. But the research and literature reviewed for this paper indicate that the higher education community has a lot to learn regarding how, and in what ways, technology can enhance the teaching/learning process, particularly at a distance."

Others agree with these conclusions. In an analysis of comparative research on distance learning technologies at the University of Oklahoma (Smith, Dillon, and Boyce, 1994), the authors asserted that designing studies which address each of the critical factors may be impractical in settings which are accessible to most researchers. They noted that when the purpose of the research is to test hypotheses (such as the relative learning benefit of one delivery system in contrast to another), studies failing to properly address the threats

to external and internal validity lead to unwarranted conclusions. They concluded that, "comparison studies in distance education are indeed limited by inadequate resources of funding to support the implementation of sufficiently controlled experimental studies."

Given the information above, it is tempting to infer that technology-mediated distance education is inferior, yet it would be a mistake to rush to that judgement. Some have overreacted to the study by suggesting that the report was hostile to the distance learning movement because the research was found to be wanting. But, it is important to understand that the conclusions by the Institute for Higher Education Policy were simply that the vast majority of the *research on distance education* did not meet acceptable standards, and, therefore, the research was inconclusive. Indeed, in other studies conducted by the Institute for Higher Education Policy, the dedication of the faculty teaching distance education at the institutions was quite apparent; they showed keen insights into the teaching/learning process, and many were considered by their peers as some of the best teachers at the institution.

As noted earlier in this report, it is estimated that over 50,000 different distance education courses were offered by accredited institutions during the 1997-98 academic year, and over 1.5 million students enrolled in these courses. Undoubtedly, many more courses are being offered now. Thus, it would be difficult, and even foolish, to argue that these courses are not effective or are of poor quality because the research to date has been sparse. It could be argued that because of the difficulty of conducting rigorous experimental studies on distance learning, it may be advisable to focus attention on the more fundamental question on how students learn, irrespective of the delivery system. Moreover, Internet-based distance education appears to be evolving its own pedagogy with the introduction of more and more audio and video and broadband access. Online courses have characteristics that are unique to the technology—which allows the exploration of new and richer pedagogical models.

Several organizations have developed principles, guidelines, and benchmarks to ensure quality distance education. These organizations include the American Council on

Education, the National Education Association, the Global Alliance for Transnational Education (GATE), the Southern Regional Electronic Campus, the Commission on Higher Education of the Middle States Association of Colleges and Schools, and the Western Cooperative for Educational Telecommunications, among others. The principles apply to a wide variety of institutional contexts and consist of fairly broad statements. In response to these and the findings of the report outlined above regarding the research on distance education, a study was conducted to validate these principles, with specific attention to Internet-based distance education. A case study of six higher education institutions recognized as among the leaders in distance education was conducted to determine those benchmarks or principles that are *essential to the quality of distance education courses* (Phipps and Merisotis, 2000).

The report describing the case study, *Quality on the Line: Benchmarks for Success in Internet-Based Distance Education,* identified 24 benchmarks as mandatory to quality distance education. Benchmarks that are mandatory were defined as those for which the absence of the benchmark would detract from quality. Stated positively, the benchmark must be essential or imperative to ensure quality. The benchmarks were separated into the following categories: institutional support, course development, teaching/learning, course structure, student support, faculty support, and evaluation and assessment. Some examples of the benchmarks include: technical assistance in course development is available to faculty, who are encouraged to use it; courses are designed to require students to engage themselves in analysis, synthesis, and evaluation as part of their course and program offerings; and intended learning outcomes are reviewed regularly to ensure clarity, utility, and appropriateness. It is important to note that it has become increasingly evident that interactivity—between student and teacher, student with other students, and student with other information—is the *sine qua non* for effectiveness in distance education.

The American Federation of Teachers (AFT) has expressed concern regarding the quality and effectiveness of technology-mediated distance learning. In a recent report, the AFT

is troubled by the way distance education is being organized and conducted (Kriger, 2001). The report states the following:

> "Much of the distance education under study here, whether non-profit or for-profit, is built on corporate ideas about consumer focus, product standardization, tight personnel control and cost effectiveness (maximizing course taking while minimizing the "inputs" of faculty and development time). These concepts are contrary to the traditional model of higher education decision-making which emphasizes faculty independence in teaching and research, academic control of the curriculum, academic freedom in the classroom and collegial decision-making."

The AFT has developed guidelines laying out 14 specific standards that address their concerns and will, they claim, ensure high quality distance education. The guidelines advance AFT's belief that "broad academic content, high standards, personal interaction and professional control are the key elements of education quality." Among the standards are: faculty must retain academic control; class size should be set through normal faculty channels; and faculty should retain creative control over use and re-use of materials.

Summary

The determination of the effectiveness of technology in the learning process is an area of inquiry that is somewhat elusive. The literature on this subject contains a plethora of references that conclude that technology-mediated distance learning compares favorably with on-campus classroom instruction. Also, many other references find that students and faculty have a positive view of their distance education learning experience. However, an analysis of the literature on the effectiveness of technology-mediated distance learning reveals that it may be too early to reach these conclusions. Reviews of the body of literature on effectiveness reveal that much of the documents are how-to articles, advocacy pieces, and second-hand reports. Original rigorous research is in short supply, and those limited studies suffer from poor methodology, which renders their

findings questionable. Some of major shortcomings of the research include the following:

- Most of the research does not control for extraneous variables, which made it difficult to identify cause and effect.

- Most of the studies do not use randomly selected subjects, which is the best way to control for extraneous variables.

- The reliability and validity of the instruments used to measure student outcomes and attitudes are questionable, which can render a lack of confidence in the findings.

There are also important gaps in the research on technology-mediated distance learning. Perhaps the most important gap in the research is the dearth of studies dedicated to measuring the effectiveness of *total* academic programs. Virtually all of the studies focus on individual courses. Another gap is that the research does not adequately explain why the dropout rate of distance learners is so high. Not only is this of concern because of the negative consequences of dropping out, but it often skews the results when comparing distance learning with classroom instruction. Finally, the effectiveness of "digital libraries" is not adequately addressed. There is some evidence that curricular objectives may be altered because of a limited variety of books and periodicals online.

The substandard research on the effectiveness of technology-mediated distance learning notwithstanding, it would be erroneous to come to the verdict that distance learning is not effective or of poor quality. These studies found fault with the *research on distance education*, not distance learning itself. There were well over 50,000 different distance education courses offered to over 1.5 million students in 1997-98, according to the best estimates. Undoubtedly many courses are offered in 2002 and more students are taking them. The vast majority of the institutions offering distance education courses are accredited and a substantial portion of faculty teaching distance education courses are full-time regular faculty who are also teaching on-campus courses. Perhaps it is time to

focus attention on the more basic question of how students learn, regardless of the delivery system. Technology-mediated distance learning is evolving its own pedagogy, and with the introduction of more audio and video and broadband access, new and richer models can be explored.

Several organizations have developed standards and guidelines to ensure quality distance education, including the Southern Regional Electronic Campus, the National Education Association, and the Western Cooperative for Educational Telecommunications. A recent study, *Quality on the Line: Benchmarks for Success in Internet-Based Distance Education,* reviewed these guidelines and attempted to validate them through actual experience of institutions recognized among the leaders on distance education. Focusing specifically on Internet-based distance education, the report identified 24 benchmarks considered mandatory for quality distance education. The benchmarks covered areas such as course development, evaluation and assessment, faculty support, and institutional support. Among the benchmarks, it has become increasingly evident that interactivity—between student and faculty, student and student, and student and information—is the *sine qua non* for effectiveness in distance education.

The American Federation of Teachers (AFT) issued a report critical of distance education, outlining their concerned of the way distance education is being organized and conducted. Specifically, the AFT alleges that much of distance education is built on corporate ideas about consumer focus, product standardization, tight personnel control, and cost effectiveness, which are not consistent with the traditional model of higher education decision-making. Fourteen standards are advanced that address their concern and include key elements revolving around faculty independence in teaching and research and collegial decision making.

Concluding Remarks

Postsecondary education is critical to our nation's vitality. The need to expand access and increase enrollment in education and training programs after high school is a public policy issue on the agenda of virtually every state. At the same time, technology is having a profound effect upon higher education. Few would disagree that technology is penetrating a variety of administrative and academic operations and impacting how colleges and universities conduct their business. Of significant importance, technology-mediated distance learning has become an integral part of the higher education enterprise.

This report attempts to address the nexus between access to higher education and technology. More specifically, how technology affects access to postsecondary education and how technology is used in postsecondary education. This framework engenders several fundamental questions. How has technology facilitated the opportunity for students to enroll in colleges and universities? Has technology enhanced the ability of colleges to reach new and expanded constituencies? To what extent do postsecondary education students have access to technology-based learning? How are students prepared to use technology in postsecondary education? Finally, how effective is technology in the teaching-learning process?

A review of over 120 references, ranging from national studies to case studies to commentaries, was conducted to answer these questions. For the most part, the literature has addressed these topics and much is known about access and technology. The ability of students to participate in postsecondary education has been enhanced by technology, albeit disparities exist. Well over a third of higher education institutions in the United States are offering distance education courses and programs. Colleges and universities are improving their admissions operations by using technology and it appears that technology is opening up new markets of potential students without materially affecting the number of students who would enroll in traditional institutions. However, the regulations of the federal financial aid system have been recognized by many as a major barrier to the ability of technology to expand access to postsecondary education.

The notion of digital divide evokes a variety of opinions. The most recent data suggests that the overall digital divide in the United States is rapidly diminishing. However disparities still exist for Blacks and Hispanics, older Americans, single-parent households and people with disabilities. Several analysts insist that a digital divide doesn't exist at all because technology is so inexpensive and those who want computers can obtain them. They assert that the low literacy rate and a lack of appropriate content on the Web are major barriers to getting lower income users online—not computer access. With respect to colleges and universities, there appears to be a consensus that a digital divide between larger institutions and smaller institutions is apparent.

Efforts to provide computers and Internet access to the nation's public elementary and secondary schools have had dramatic results. Fully 98 percent of the schools enjoyed Internet access in 2000, irrespective of the poverty concentration of the students, location, and level of school. Focusing on individual classrooms, about four out of five of the classrooms have Internet access, yet there are differences in school characteristics. Schools with higher levels of poverty students had less access to the Internet in classrooms than schools with lower levels of poverty. Paralleling these data, teachers in high poverty schools use computers and the Internet less than teachers in more wealthy schools. Regardless of the number of computers in schools, some argue that, because of the condition of computers and the lack of training for teachers, computers are not being used to their potential and are merely glorified typewriters. Looking at computers in the home, about two-thirds of children 3 to 17 years of age lived in a household with a computer in 2000, yet again, differences remain. Black and Hispanic children were less likely to live in homes with computers than other races. Focusing upon higher education students, a survey of Fall 2000 college freshmen reveals that most are computer literate.

Judging the effectiveness of technology-mediated distance learning has been somewhat obscure. Although there is a considerable amount of information on this subject, most of the research has substantial methodology problems, thereby rendering their findings inconclusive. In an effort to ensure quality of online distance education courses, several

higher education organizations have promulgated benchmarks and standards to be used by faculty and institutions.

This compendium of findings helps to discern the relationship between technology and access to postsecondary education. Yet, because of the dramatic pace of technology growth, information becomes old news very quickly. Thus, much of the data need to updated at regular intervals. The number of distance education courses and programs requires continuous monitoring. The number and type of higher education institutions providing technology-mediated distance learning should be assessed again, particularly since many had plans to offer distance learning courses and programs. Looking at the broader picture, the issue of computer and Internet access in the general populace, the elementary and secondary schools and among higher education institutions needs persistent observation. Also, understanding the extent to which faculty in K-12 and higher education use computers and the Internet is an area that requires updating.

Additional Questions?

In addition to making sure that the data are current, several questions can be addressed that would expand our understanding of the relationship between technology and access to postsecondary education.

The following questions regarding preparation are pertinent.

- To what extent are teachers trained to use computers and access the Internet?
- Are the computers in the elementary and secondary schools up-to-date and maintained, and are there differences among communities?
- Are teaching methods being altered because of the use of computers or are computers just another bell or whistle with little impact upon pedagogy?
- What are the barriers that inhibit students from using computers and the Internet?

Financial aid is another area of concern.

- How many students are not taking distance learning courses because of Title IV regulations?

- Are state financial aid requirements presenting barriers to distance education students and, if so, how?
- To what extent are students refraining from taking courses from more than one institution because of financial aid restrictions?

Questions remain regarding the quality and effectiveness of distance education.

- How are colleges and universities assessing the effectiveness of their technology-mediated distance education courses?
- Are faculty and/or the institutions using different methods to determine effectiveness for distance education courses versus traditional classroom courses?
- To what extent are new models of teaching/learning being explored in higher education because of technology?

An essential component of good public policy is good and reliable information. Much has been written about the twin topics of technology and access to postsecondary education. However, because of the striking pace of technological advances and the proliferation of new players in the higher education community, the issues are like quicksilver and the landscape keeps shifting. Monitoring these phenomena requires continual vigilance through periodic data collection and informed analysis.

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